

8. (a) Given $\frac{dy}{dx} = x^2(1+y)$ and $y(1) = 1$, $y(1.1) = 1.233$,
 $y(1.2) = 1.548$, $y(1.3) = 1.979$, evaluate $y(1.4)$ by
 Adams-Bashforth method. 10

- (b) Fit a second degree parabola to the following data :

| | | | | | | | |
|-------|-----|-----|-----|-----|-----|-----|-----|
| $x :$ | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 | 3.5 | 4.0 |
| $y :$ | 1.1 | 1.3 | 1.6 | 2.0 | 2.7 | 3.4 | 4.1 |

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Roll No.

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BT-4/M-13

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COMPUTATIONAL TECHNIQUES

Paper : MAT-204(E)

Time : Three Hours]

[Maximum Marks : 100

Note : Attempt *five* questions in all, selecting at least *one* question from each unit.

UNIT-I

1. (a) Using the method of separation of symbols, prove that

$$u_1x + u_2x^2 + u_3x^3 + \dots = \frac{x}{1-x}u_1 + \left(\frac{x}{1-x}\right)^2\Delta u_1 + \left(\frac{x}{1-x}\right)^3\Delta^2 u_1 + \dots \quad 6$$

- (b) From the following table, estimate the number of students who obtained marks between 40 and 45 :

Marks : 30-40 40-50 50-60 60-70 70-80

| | | | | | |
|-------------------|----|----|----|----|----|
| No. of Students : | 31 | 42 | 51 | 35 | 31 |
|-------------------|----|----|----|----|----|

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- (c) Given the values

| | | | | | |
|----------|-----|-----|------|------|------|
| x : | 5 | 7 | 11 | 13 | 17 |
| $f(x)$: | 150 | 392 | 1452 | 2366 | 5202 |

Evaluate $f(9)$ using Lagrange's formula. 6

2. (a) Given that :

| | | | | | | | |
|-----|-------|-------|-------|-------|-------|-------|--------|
| x : | 1.0 | 1.1 | 1.2 | 1.3 | 1.4 | 1.5 | 1.6 |
| y : | 7.989 | 8.403 | 8.781 | 9.129 | 9.451 | 9.750 | 10.031 |

Find $\frac{dy}{dx}$ and $\frac{d^2y}{dx^2}$ at $x = 1.1$. 10

- (b) Evaluate $\int_0^6 \frac{dx}{1+x^2}$ by using (i) Trapezoidal rule,
(ii) Simpson's $\frac{1}{3}$ rule, and compare the results with its actual value. <http://www.kuonline.in> 10

UNIT-II

3. (a) Form the difference equation corresponding to the family of curves $y = ax + bx^2$. 7
(b) Solve : $y_{n+1} - 2y_n \cos \alpha + y_{n-1} = 0$. 3
(c) Solve : $y_{n+2} - 4y_n = n^2 + n - 1$. 10

4. (a) Using Gauss-Jordan method, solve the system of equations,

$$\begin{aligned} 10x + y + z &= 12; \\ x + 10y + z &= 12; \\ x + y + 10z &= 12. \end{aligned} \quad \text{by Relaxation method.} \quad \text{10}$$

- (b) Solve the system of equations,

$$\begin{aligned} 4x - y &= 1; \\ -x + 4y - z &= 0; \\ -y + 4z &= 0, \end{aligned} \quad \text{by using Cholesky method.} \quad \text{10}$$

UNIT-III

5. (a) Find a real root of the equation $x^3 - 2x - 5 = 0$ by the method of false position correct to three decimal places. 10

- (b) Show that Newton's method has a quadratic convergence. 10

6. (a) Solve by Jacobi's iteration method, the system of equations :

$$\begin{aligned} 20x + y - 2z &= 17; \\ 3x + 20y - z &= -18, \\ 2x - 3y + 20z &= 25. \end{aligned} \quad \text{10}$$

- (b) Solve the following system of equations :

$$\begin{aligned} 9x - 2y + z &= 50; \\ x + 5y - 3z &= 18; \\ -2x + 2y + 7z &= 19 \end{aligned}$$

by Relaxation method. 10

UNIT-IV

7. (a) Using Euler's method, find an approximate value of y corresponding to $x = 1$, given that $\frac{dy}{dx} = x + y$ and $y = 1$, when $x = 0$. 10

- (b) Using Runge-Kutta method, solve $\frac{dy}{dx} = \frac{y^2 - x^2}{y^2 + x^2}$ with $y(0) = 1$ at $x = 0.2, 0.4$. 10